

DOCUMENT RESUME

ED 193 884

EC 131 302

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 TITLE Effects of Stimulus Fading Procedures on
 Overselectivity in Autistic Children.
 PUB DATE 80
 NOTE 23p.; Paper presented at the Meeting of the Western
 Psychological Association (Honolulu, HI, April,
 1980).
 EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS *Autism; Exceptional Child Research; *Learning
 Processes; *Prompting; Stimuli
 IDENTIFIERS Overselectivity

ABSTRACT

The efficacy of three types of prompt fading procedures used in teaching discrimination tasks was investigated in eight autistic and three nonautistic students (5 to 12 years old) with varying intellectual abilities. Results showed no significant difference in task acquisition between within stimulus distinctive, extra stimulus nondistinctive, and distancing prompt fading procedures. Of the autistic Ss, three eventually learned in all prompt conditions, three failed to learn in all conditions, and two learned in some but not all conditions. Results failed to support A. Rincover's findings that the within stimulus distinctive prompt fading procedure circumvents overselectivity and thus is the most effective prompt fading procedure to use with autistic Ss. Little evidence was found for overselectivity, and it was suggested that differential learning patterns, along with overall functioning level of autistic children, may help determine the efficacy of prompt fading procedures. (Author/CL)

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EFFECTS OF STIMULUS FADING PROCEDURES ON
OVERSELECTIVITY IN AUTISTIC CHILDREN

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Effects of Stimulus Fading Procedures
on Overselectivity in Autistic Children

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An accumulation of evidence suggests that autistic children, in general, have difficulty responding to cues presented simultaneously in a given sensory modality (Koegel & Wilhelm, 1973; Reynolds, Newsom, & Lovaas, 1974; Schreibman & Lovaas, 1973) and across multiple modalities (Lovaas & Schreibman, 1971; Lovaas, Schreibman, Koegel, & Rehm, 1971). The investigators in all these studies reported that autistic children typically respond to only a few cues from a larger range of available relevant cues in discrimination learning tasks. These children were highly selective in their responses to multiple-cue complexes, showing restricted responding when the stimuli were presented individually. Lovaas and his colleagues claim that this selective responding indicates an attentional deficit in autistic children, referred to as "overselectivity" (Lovaas, Schreibman, Koegel, & Rehm, 1971).

"Stimulus overselectivity" has been used to explain why autistic children fail to learn observationally (Lovaas & Newsom, 1976), respond to social stimuli (Schreibman & Lovaas, 1973), acquire speech (Reynolds, et al., 1974), develop appropriate emotional responses (Lovaas & Newsom, 1976), transfer prompted responses to appropriate environmental stimuli (Koegel & Rincover, 1976), and to explain the general failure of training efforts to generalize to other situations (Rincover & Koegel, 1975). Based on these research findings, stimulus overselectivity has been identified by some as the primary deficit in autism (Kovattana & Kraemer, 1974). Observed behavioral deficits and excesses are

considered to be a secondary result of this problem.

Efforts to deal with the overselectivity phenomenon have been twofold. One approach has been to deal with it directly by teaching those children evidencing overselectivity to respond to multiple cues. The second approach has been to accept the phenomenon of overselectivity as an irreversible characteristic of these children and has attempted to compensate for this attentional deficit. Researchers following this second approach have investigated ways to devise teaching methods which circumvent the problem rather than remedy it.

Based on discrimination learning research focusing on an organism's responding as a function of stimulus variables as opposed to reinforcement variables prompt fading techniques have been found to be effective in speeding up acquisition of discrimination tasks. Unfortunately, it appears that autistic children, who are much in need of the extra guidance of fading procedures, are those who benefit least from prompt fading (Litrownik & McInnis, 1980). In traditional prompt fading procedures, subjects must respond to multiple cues presented simultaneously, i.e., the prompt and the training stimulus, in order for transfer from the pre-trained prompt to the training stimulus to occur without error (Fields, Bruno, & Kellar, 1976). If transfer occurs during the fading procedure, the subject will continue to respond correctly when the prompt is removed. Autistic children, however, appear to fail to respond correctly in the latter stages of fading and upon removal of the prompt. Some researchers have suggested that the ineffectiveness of prompt fading procedures with autistic children may be due to the extreme selective attention they display (Schreibman, 1975; Rincover, 1978). As a result, efforts have been made to redesign fading techniques with more lenient attentional requirements for these subjects, so as to compensate for their overselectivity (Rincover, 1978).

Presuming that prompt fading might facilitate learning in autistics if the attentional requirements were reduced then if autistics can learn to respond to one component of a complex stimulus, it might be possible to use aspects of that component as a prompt. Attempts to transfer control would then occur within that component. According to Schreibman (1975), autistics appear to be capable of discriminating the prompt stimulus—therefore, if the prompt stimulus was incorporated within the training stimulus so that the child did not have to respond to two stimuli, then he or she should acquire the discrimination more easily.

Based on this premise, Schreibman (1975) designed an experiment in which she compared two different prompting procedures to teach visual and auditory discriminations to autistic children. In one procedure, an external cue (extra-stimulus prompt) was utilized requiring the autistic children to attend to both the prompt and the training stimulus. The second procedure involved the exaggeration of the stimulus itself (within-stimulus prompt), wherein subjects had to attend only to the training stimulus. Results showed that the children failed, in each instance, to acquire a discrimination with the extra-stimulus (ES) prompt, but demonstrated significantly greater learning when the within-stimulus (WS) prompt was employed.

Rincover (1978) verified the results of Schreibman's work and expanded it in a study designed to assess the effects of two types of prompt fading techniques—within-stimulus (WS) versus extra-stimulus (ES) and distinctive feature (DF) versus non-distinctive feature (NDF) on the discrimination learning of autistic children. Four treatment procedures utilizing a total of eight autistic children, were employed, corresponding to the four possible combinations of these two variables. In each procedure, the discrimination consisted of two three-letter words, one arbitrarily designated as the target stimulus (S+) and the other as the negative stimulus (S-). In those target discriminations containing a distinctive feature variable, Rincover selected as a prompt a feature of the S+

training stimulus contained only in the S+, not the S- stimulus. In the non-distinctive condition, children were pretrained on a feature contained in both the S+ and S- stimulus.

Three major findings were reported: (1) more target discriminations were acquired when the pretrained feature was distinctive, rather than nondistinctive, to the S+, (2) more discriminations were acquired during WS fading than during ES fading, independent of whether the pretrained feature was a DF or NDF of the S+, and (3) when a discrimination was not learned during the ES fading condition, errors generally occurred on the final fading step.

Several problems became apparent, however, upon closer examination of the Rincover study. In particular, specific aspects of the training procedure needed further clarification. For example, only a limited number of training trials were afforded each child during the fading sequence. That is, for each discrimination task, criteria for termination consisted of failing at any one of six fading steps on two consecutive attempts (e.g., two errors out of 10 trials). Such stringent criteria increase the risk of termination given the management problems (i.e., sitting still, etc.) characteristic of autistic children, and raise questions about whether the conclusions reached for each prompt technique are warranted.

Rincover (1978) also reported that overselective responding was still evidenced by children who successfully completed the WSDF procedures. After the fading steps were completed, an assessment of stimulus control for this prompt technique followed. He found that the children were making the discrimination based on the first letter of the S+ word only, which incorporated the prompt, and were ignoring the remaining two letters. Thus, it may be that the WSDF procedure facilitates transfer of stimulus control from the prompt to the S+ but this transfer is to a restricted aspect of the S+. In summary, (1) the WSDF

procedure appears to be a promising prompt fading technique, however (2) its value is based on a limited amount of empirical evidence, and (3) further research is needed to more clearly assess the effectiveness and efficiency (number of trials) of this method as compared to other fading procedures.

Richter (1979) attempted to partially replicate the Rincover study by systematically assessing the effects of two fading conditions—within-stimulus, distinctive feature (WSDF) and extra-stimulus, nondistinctive feature (ESNDF) on three letter discrimination learning of autistic children. These conditions were specifically chosen as they represented the two extremes of successfully completed discrimination paradigms as reported by Rincover (1978). In addition, Richter proposed to extend training over more trials and thus modify the failure criterion imposed by Rincover in order to determine if the children who failed on the extra-stimulus condition could acquire the discrimination if allowed more training. Ability to acquire the discrimination in this extra-stimulus condition would enable investigation of possible restricted responding which might occur due to the type of prompt procedure, specifically the within-stimulus prompt. Thus, it may be possible to determine if the extra-stimulus prompt procedure, even though it may require more training time, may ultimately avert the restricted responding that may be occurring as a result of the within-stimulus prompt procedure. Unfortunately, Richter was unable to replicate Rincover's (1978) findings and thus these questions were unanswered. Richter reported the subjects to have either successfully learned the target discrimination with both prompt procedures, or to have failed regardless of the prompt procedure utilized. Furthermore, failures occurred at all stages of prompt fading, not just the final step. These results suggest that it may not be specifically the removal of the prompt that causes the failure to learn the target discrimination, as Rincover suggested.

One explanation for this failure to replicate Rincover's (1978) results

centers on the subjects' possible prior learning history. In the Richter study (1979), the subjects had no previous learning experience with the experimenter. In addition, the study was conducted in a location which the subjects had had no experience with and the sessions themselves were handled in a very rigid and experimental fashion. Taking into account autistic children's frequent failure to generalize training efforts to other situations (Rincover & Koegel, 1975), it is possible that the subjects' lack of experience with the experimenter, the unfamiliar environment, and the rigidity of the experimental sessions, could have influenced their behavior. These factors may not have been discriminative stimuli for working behavior. Thus, Richter's obtained results may be invalid. Unfortunately, Rincover (1978) did not discuss these factors, so it is not known whether these environmental variables played a part in Richter's failure to replicate.

The present study is another attempt to replicate Rincover's (1978) research in assessing the efficacy of within-stimulus and extra-stimulus prompt fading procedures on discrimination task learning in autistic children. In order to determine whether Richter's failure to replicate was due to the above mentioned variables, the subjects were trained by their usual teachers, in their everyday classrooms, using the appropriate behavioral techniques for each child, throughout the study. In this way it was hoped that the subjects would not discriminate between normal school activities and the experiment.

Methods and Results

Eight children, five boys and three girls, clinically diagnosed as autistic participated in this study. All of the children showed a history of characteristic autistic behaviors, such as lack of meaningful social contact with others in their environment, ritualistic, stereotyped movements, lack of or poor communication skills, early onset of symptoms, etc. Five of the children were also

subjects in the Richter (1979) study so that those results could be more clearly interpreted. The retesting of these subjects was six months after the Richter (1979) study so it is felt their prior experience with this task would not be a factor. Unlike the participants in Rincover's (1978) study, the subjects used in this study showed a broad range in chronological age and demonstrated intellectual abilities. Chronological age ranged from 5-1 to 12-3, while mental age, as measured by the Alpern Kimberline Short Form of the Binet-Cattell, ranged from 1-9 to 4-0. Comparatively, two of the subjects were fairly high functioning with both expressive and receptive language skills, four had moderate intellectual functioning with somewhat less expressive and receptive language ability, and two were lower functioning with little language ability. In addition to the primary subjects, three non-autistic children with various behavioral problems, were also included in this study for comparison purposes. Of these children, chronological age ranged from 6-8 to 9-1 and mental age from 3-9 to 5-3. All of the children were students at Los Ninos Center in San Diego.

The procedure used was similar to that used by Rincover (1978) and Richter (1979). During each session the child was seated at a small rectangular table in his/her usual classroom. The subject's normal teacher for that segment of time sat across the table facing the child in order to conduct the training. The reinforcers, as well as the behavior management techniques, were the ones normally used for each individual child. All of the subjects received training on the same two discrimination tasks, although the order of presentation was randomized across subjects.

Each discrimination task consisted of two three-letter words, one arbitrarily designated as the positive, or target, stimulus (S+) and the other as the negative stimulus (S-). The two tasks used in this experiment were:

(a) "BUN" versus "SAG," and (b) "JAR" versus "SON." These task stimuli were

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selected because they were analogous to the kind of discriminations likely to be encountered in teaching situations (Rincover, 1978).

There were two kinds of trials used in each fading procedure: (a) prompt pretraining, in which a child was taught to respond to an exaggerated feature of the S+, and (b) prompt fading, in which the pretrained feature was presented together with the target words and the exaggeration was gradually removed. During all pretraining trials, the exaggerated feature of the S+ was situated 3.9 cm. directly above the position it would normally assume in the S+ word. During subsequent fading trials, the exaggeration of the prompt was gradually removed by reducing the thickness of the pretrained feature. For both procedures the exaggeration was gradually reduced in the following six steps: full exaggeration: (a) .4 cm., (b) .32 cm., (c) .24 cm., (d) .16 cm., (e) .08 cm., and no exaggeration: (f) 0 cm. (The pretraining and fading steps are illustrated in Figure 2 of the Appendix.) The following two fading procedures were used.

Within-stimulus, distinctive feature fading (WSDF). In the WSDF procedure, a child was pretrained to respond to a feature of S+ which was not contained in S- (i.e., a distinctive feature). During pretraining, this prompt was exaggerated and presented alone. Subsequently, the S+ and S- were presented with the pretrained exaggerated prompt superimposed on the S+ word (i.e., within-stimulus). At that point, the exaggeration of the prompt was gradually faded until S+ took its normal form. In a discrimination between JAR (S+) and SON (S-), the top horizontal line in the J was selected for pretraining. During pretraining the learner was taught to respond to an exaggerated version of this feature. Initially, the experimenter presented only one card, consisting solely of the exaggerated distinctive feature. The position (right or left) of this card was randomly alternated in a Gellerman (1933) order. These trials continued until the child responded correctly on 10 consecutive trials. When a child

reached this criterion, the same card was then presented simultaneously with a blank S- card until the child again evidenced 10 consecutive correct responses.

After pretraining, the complete S+ (JAR), including the pretrained exaggerated feature, and the S- (SON) were presented simultaneously and fading was initiated. Initially, trials were presented in which the top horizontal line of the J was .48 cm. thick (.40 cm. exaggerated plus the normal .08 cm. thickness), and the exaggeration was gradually removed in six steps.

The exaggeration was faded in a modified back-up procedure (Rincover, 1978). The child always received five trials at each level of exaggeration unless he/she made an error. This insured that the child was responding correctly at one level before being advanced to a more difficult level. If a child responded correctly on five consecutive trials at a given level, he/she was advanced to a reduced level of exaggeration. If an error occurred, he/she was immediately returned to the previous level of exaggeration, at which he/she responded correctly. After five consecutive correct trials at this level, he/she was returned to the level at which he/she had previously responded incorrectly. This modified back-up procedure was used in an attempt to insure the reliability of errors which occurred at a particular fading step before the fading procedure was terminated. This fading procedure continued until the student either learned the target discrimination or until he/she erred at a particular fading step on two consecutive attempts.

Extra-stimulus, nondistinctive feature fading (ESNDF). In the ESNDF procedure, a child was pretrained to respond to a feature of S+ which was also contained in S- (nondistinctive feature). Subsequently, during fading, the pretrained feature was presented above and spatially separate from the S+ word (extra-stimulus). In the discrimination between BUN and SAG, the lower curve contained in both the B and the S was used during pretraining. During fading, the exaggerated feature was presented on the S+ card directly above the B. The thickness of

that feature was reduced, in six steps, until the S+ word was presented alone.

No consistent performance pattern was demonstrated by the autistic subjects. Two of the eight autistic children learned the discrimination in both the extra-nondistinctive and within-distinctive prompt conditions. Of the two children, one was high functioning while the other was at a moderate level of intellectual functioning. Four subjects failed both conditions at the first two training steps, while another child failed to get through pre-training for either condition. Only the highest functioning subject showed better performance on the within-distinctive condition, learning the discrimination, than on the extra-nondistinctive condition, failing on the sixth step, as Rincover (1978) would predict. Overall, the subjects did not seem to demonstrate the overselectivity that would be expected. Thus, the results are consistent with Richter's (1979) failure to replicate Rincover's findings.

Since Rincover's (1978) failure criterion was rather stringent, it was decided to modify the procedure for three subjects who failed both conditions early in the training. The modified procedure involved giving additional pretraining if the subject failed at step 1 and continuing the training even when two consecutive errors, failure criterion, were made. The intent of the modified extra training was to see if the subject could learn the discrimination on either prompt procedure.

Again, the three subjects given the extra training performed differently. One subject with moderate intellectual functioning correctly learned the discrimination in the within-distinctive condition when given extra training, but failed at the sixth step on extra-nondistinctive condition. Thus, when extra training was given, this subject's performance was similar to Rincover's (1978) findings. One subject who was moderate functioning learned the discrimination in both conditions with extra training. However, the third subject, with low intellectual functioning, when given extra training continued

to fail at the first step on both prompt conditions. Subsequently a further modification in the procedure was enacted for this subject and another subject, who was also low functioning, and who had failed early in the training on both conditions using Rincover's (1978) criterion but was not given extra training.

For these two subjects it was decided that the three-letter word discrimination may have been too complex, so a single letter discrimination, using the first letter in each word only and covering up the remaining letters, was tested.

Both subjects failed to learn the single-letter discrimination in both prompt conditions. In addition, failure for both subjects took place at the first step in the training. Thus, the simplified single letters procedure did not improve performance for these subjects.

It is interesting to compare the autistic subjects' performance to the non-autistic subjects' for the three-letter discrimination task. Similar to the autistics, the three non-autistic children showed no particular performance pattern. When Rincover's (1978) criterion was followed, one of the three subjects learned the discrimination on the extra-nondistinctive condition but failed on the first step of the within-distinctive condition. Following the within-distinctive condition failure, additional training trials were administered and the subject finally learned the discrimination. The second non-autistic subject was tested only on the within-distinctive prompt condition and correctly learned the discrimination. The third non-autistic subject failed on the sixth step in both prompt conditions. Additional training was given, however, the subject continued to fail at the sixth step. It is of interest to note that at the sixth step of each condition the subject frequently asked "Where did it go?" referring to the stimulus prompt. Thus, this child was clearly overselective.

The above results and Richter's (1979) findings bring into question the claimed superiority of within-stimulus prompt fading procedures for enhancing discrimination learning in autistic children. This suggests a need for considering alternative prompt procedures that would reduce the effect of stimulus overselectivity, or circumvent this attentional deficit, to allow for increased learning in autistics. A technique that may prove to be an effective prompt procedure with these children is one utilizing a distancing cue. This type of cue has frequently been used in classroom settings with autistics to provide a prompt after an incorrect response to a discrimination learning trial has occurred. With such a technique the S+ and S- training stimuli are presented such that the S- is farther away than the S+ (i.e., distanced) from the subject so that the close proximity of the S+ to the subject relative to the S- prompts the correct response. It is possible that integrating this distancing cue into a systematic prompt procedure will be effective in facilitating discrimination learning in autistic children. This type of prompting procedure was next attempted with all of the autistic subjects except the one who failed the pre-training stages.

In the distancing prompt procedure, like in the within- and extra- prompt procedure, two types of trials were used: (a) prompt pretraining, in which the child was taught to respond to the S+ training stimulus which was initially presented alone and subsequently in combination with a distanced blank stimulus card; and (b) prompt fading, in which the distancing prompt was gradually faded until the S+ and S- stimulus cards were adjacent and equidistant from the subject. The distancing prompt procedure paralleled the within- and extra- stimulus procedures in that Rincover's (1978) criterion for success and failure was followed.

During pretraining-Stage 1 the S+ training stimulus was presented singly to the subject until he was responding correctly as per the first stage of the pre-

training procedure of the within- and extra- stimulus conditions. During Stage 2, the S+ card was presented in combination with a blank stimulus card. These two stimulus cards were positioned so that the S+ card was 25 cm. closer to the subject than the blank card. Thus, the blank card was distanced from the subject and served as a distancing prompt to encourage correct responding to the S+ stimulus.

Upon successful completion of pretraining, the training phase was initiated in which the blank stimulus card was replaced by the S- training stimulus. Through a six-step fading procedure similar to the within- and extra- stimulus prompt fading procedures, the S- card was moved forward 5 cm. at each of the six steps until ultimately it was adjacent to the S+ card, thus fading the distancing prompt. Reward and modified back up fading procedures were identical to the aforementioned conditions. Position of the S+ card was randomized in a Gellerman (1963) order.

Using the distancing prompt, two of the autistic subjects learned the discrimination while the other five failed at various steps. Interestingly, one child who learned was the same subject who learned both discriminations using the within-distinctive and extra-nondistinctive prompt procedures. Two of the subjects who failed to learn on this distancing prompt condition were given additional training and finally successfully learned the discrimination.

In summary, it appears that the distancing prompt is not any more effective than the within-distinctive or extra- nondistinctive prompt procedures. While four subjects finally learned the discrimination using the distancing prompt, five subjects eventually learned with the use of the within-distinctive prompt procedure. While only three of the subjects learned the discrimination on the extra-nondistinctive prompt procedure it is possible had several other subjects had additional training more would have learned. It is of interest to note that two subjects tested on all three prompt conditions failed to learn with any of the prompt procedures. Both of these subjects were low functioning with very little verbal ability.

Discussion

The results of the present study, along with Richter's (1979) findings strongly suggest that the within-stimulus distinctive prompt procedure is not superior to the extra-stimulus nondistinctive prompt procedure for all autistics, as Rincover (1978) suggested. Rincover's (1978) claim that autistics' failure to learn on this extra-stimulus prompt condition is due to their extreme selective attention and that within-stimulus prompts avert the overselectivity phenomenon does not seem to be supported. Only one subject in the present study performed as Rincover (1978) would predict, by passing on the within-stimulus distinctive condition but failing on the sixth step of the extra-stimulus non-distinctive condition. All other subjects either learned or failed on both conditions, and when failure did occur it was at the earlier stages of prompt fading rather than the latter. Furthermore, results of using the distancing cue as a systematic prompt procedure failed to provide evidence for the superiority of this prompt procedure. Thus, while the subjects may have been over-selective, no prompt condition was more effective than another in averting selective responding. Indeed, little evidence of selective responding was demonstrated by the autistics but, interestingly, was clearly demonstrated by a non-autistic subject when he asked "Where is it?" in reference to the prompt.

It appears that differential learning patterns of autistic children may play a role in the relative effectiveness of a particular prompt procedure. The one subject who performed as Rincover (1978) would predict, was functioning at a high level relative to the other subjects. However, the subjects who learned on both prompt conditions had high and moderate intellectual functioning, while the subjects who failed on both conditions were at a moderate or low functioning level. It seems appropriate that one must consider the complexity of the task, the child's learning history, and his/her present level of intellectual functioning when deciding the type of prompt procedure to be

utilized. Overall, however, it appears that the child either learns the discrimination with all three prompt procedures or fails to learn with all three.

The relative efficacy of one prompt fading procedure over another has not been demonstrated. It seems appropriate that future efforts be directed toward identifying autistics with similar learning abilities and then finding training procedures appropriate for each group. The fact that only the highest functioning autistic subject demonstrated overselectivity suggests that efforts should be taken to identify and assess attentional and/or perceptual deficits in each child. Furthermore, when considering which prompt procedure to use, the overall cost effectiveness of each procedure must be considered. The question whether the within-stimulus prompt procedure causes restricted responding by forcing the child to attend only to the first letter is still unresolved. It is possible that while the extra-stimulus prompt procedure may take a longer training period, it may ultimately avert the possible restricted responding caused by the within-stimulus prompt procedure.

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APPENDIX

Figure 1. Summary Table of Subjects' Functioning Levels and Performance Across Experimental Conditions

Subject	CA	MA	IQ	Verbal	General	S from	Three Letter Discrimination	Single				Distancing			
					level	Richter		letter					prompt		
					funct.	study		disc.							
					Order	Rinconer's		Additional		Rinconer	Additional				
							Extra	Within	Extra	Within	Extra	Within	criterion	training	
Autistic															
S ₁	12-3	3-3	34	No	Mod.		E/W	D	D					D	
S ₂	11-1	3-9	38	Yes	High		W/E	D	D					F1	D
S ₃	9-11	4-0	41	Yes	High	X	E/W	F6	D					D	
S ₄	5-1	3-0	55	Yes	Mod.	X	W/E	F2	F1	F6	D			F4	
S ₅	6-1	2-0	33	No	Low	X	W/E	F1	F2			F1	F1	F2	
S ₆	6-1	1-9	29	No	Low	X	E/W	F1	F1	F1	F1	F1	F1	F4	
S ₇	5-10	1-9	30	No	Mod.	X	W/E	F1	F1	D	D			F6	D
S ₈	5-1	2-0	32	Yes	Mod.		E/W	F pre	F pre						
Non-Autistic															
S ₉	8-7	5-3	59	Yes			W/E	D	F1		D				
S ₁₀	6-8	5-5	76	Yes			W		D						
S ₁₁	9-1	3-9	40	Yes			E/W	F6	F6	F6	F6				

E = extra non-distinctive prompt; W = within distinctive prompt; F = step at which failure occurred;
D = discrimination learned

Within-Stimulus
Distinctive
Feature

Extra-Stimulus
Nondistinctive
Feature

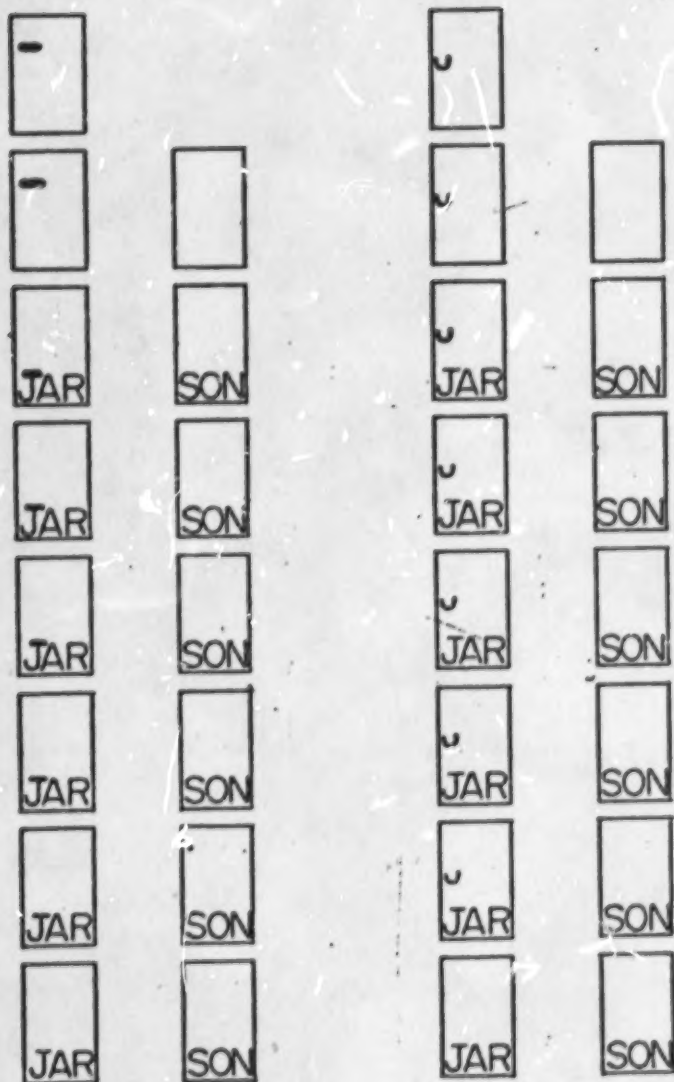


Figure 2. Illustrations of pretraining and training stimulus cards similar to those used in within-stimulus distinctive feature and extra-stimulus nondistinctive feature conditions.